AME 430: Thermal Systems Design (3 units) – Section 28772

Syllabus (Rev. 0)

Fall 2014

Instructor: Dr. Rick Martin
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RJM Office: BHE-315
RJM Office Hours: Th 9:30 am – 12:30 noon

Lecture Times: Th 2:00 pm – 4:50 pm
Lecture Location: VHE-210

Teaching Assistant: <none>

Required course text:
Thermal Systems Design; Various authors (assembled by R. Martin). **REQUIRED (eBook or Softcover)**

Catalog Description: Design methodology for thermal systems; boilers, condensers, air conditioning systems, power plants and other systems with thermal energy interaction. Recommended Preparation: AME 312 and AME 331.

Instructor's Description: Following a brief review of thermodynamics, fluid mechanics and heat transfer, plus a brief introduction to combustion, students will engage in a step-by-step design effort for one of three projects (wood-waste fueled lumber kiln; landfill gas combustion turbine; earth-coupled heat pump). Student work product will be a Process Design Package, including: Heat and Material Balance, Process Flow Diagram, Piping & Instrumentation Diagram, and Equipment Data Sheets, plus a Group Presentation.

Homework: A total of 11 homework assignments will be given (see schedule). Each homework assignment is worth 50 points. Late homework will be docked 25%.

Design Deliverables: Each team will receive a Request for Proposal from their "client" that sets forth the scope of work the design team is expected to deliver. Each student is individually responsible for a "DRAFT" version of the PFD and P&ID drawings, plus equipment data sheets for their group's project

(points included in homework assignment totals above). Time will often be available at the end of class for groups to work on their designs together, and to interact with the instructor if they have questions.

Final Presentation AND Design Package: Each group will have an opportunity to communicate their thermal system design to their classmates with an oral presentation and design package, worth 250 points per student. Each team member is required to deliver a portion of the group's final presentation to the class and respond to questions from students and the instructor. The presentation should include content that focuses on (a) unique aspects of the design, (b) cost savings for the end customer, and (c) benefits to the environment or local economy. Individual scores will be based in part on the group's work product and in part on the student's individual contribution to the design package and presentation.

Final Exam: A final exam, worth 200 points, will be given on the scheduled date. The exam will cover all subjects covered in the lectures and assigned reading. The exam will focus on concepts rather than calculations, although some analysis will be necessary to answer some questions.

Final Grades: Letter grades will be assigned at the end of the class according to the following scale:

- A 920 or more
- A- 880 to 919 points
- B+ 850 to 879 points
- B 820 to 849 points
- B- 790 to 819 points
- C 700 to 789 points
- D 600 to 699 points
- F 599 points or fewer (fail)

Statement for Students with Disabilities:
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity:
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

WEEK NO.	DATE	SUBJECT	ASSIGNED READING (Text - Thermal Systems Design)	WORK PRODUCT DUE	Pages for HW Assignment Due	POINTS
1	8-28	Thermodynamics Fundamentals	Chapters 1 (First Law), 2 (Second Law) and 3 (Reversible Work) <Schaum's Thermodynamics>	*<None>*	*<Lecture Only>*	
2	9-4	Fluid Flow Fundamentals	Chapter 4 (Internal Flows) <Schaum's Fluid Mechanics>	Homework #1 - Thermo	Schaum's Thermodynamics Problems tbd	50
3	9-11	Heat Transfer Fundamentals	Chapter 5 (Laminar Convection), Chapter 6 (Turbulent Convection), Chapter 7 (Heat Exchangers) <Schaum's Heat Transfer>	Homework #2 - Fluids	Schaum's Fluid Mechanics Problems tbd	50
4	9-18	Combustion Fundamentals	Chapter 8 (Combustion) <Schaum's Thermodynamics>	Homework #3 - Heat Transfer	Schaum's Heat Transfer Problems tbd	50
5	9-25	Heat and Material Balance, PFD, Customer RFP	Chapter 9 (Importance of Process Diagrams) <Thakore, Bhatt>	Homework #4 - Combustion	Schaum's Thermodynamics Problems tbd	50
6	10-2	Compressors, Blowers, Pumps	Chapter 10 (Process Design of Piping) <Thakore, Bhatt>	Homework #5 - Draft H&MB	Draft PFD, HMB (*Individual Student*)	50
7	10-9	Recuperators , Burners, VOC Destruction, ThermOx, Insulation	*Blackboard Content*	Homework #6 - Resistance to Flow	Thakore/Bhatt Problems tbd	50
8	10-16	Boilers	Chapter 11 (Fossil Fuel Steam Generators) <El-Wakil>	*<None>*	*<Lecture Only>*	
9	10-23	Combustion Turbines	Chapter 12 (Gas Turbines and Combined Cycle) <El-Wakil>	Homework #7 - Boilers	El-Wakil Problems tbd	50
10	10-30	Refrigeration Systems; Transient Heat Flow	Chapter 13 (Refrigeration Cycles) <Schaum's Thermodynamics>	Homework #8 - Brayton Cycle	El-Wakil Problems tbd	50
11	11-6	Instrumentation, P&ID, Equipment Specs	*Blackboard Content*	Homework #9 - Refrigeration Systems	Schaum's Thermodynamics Problems tbd	50
12	11-13	Valves, Actuators, Process Control, Emission Monitor	Chapter 14 (Process Control) <Dunn>	Homework #10 - Draft P&ID	Draft P&ID, Draft Equipment Data Sheets (*Individual Student*)	50
13	11-20	O&M Manual, Process Hazard Assessment, Product Quality	*Blackboard Content*	Homework #11 - Process Control	Dunn Problems tbd	50
14	11-27	THANKSGIVING BREAK				
15	12-4	Project Presentations	*<none>*	Group Presentations	Submit (*Group*) PPT, Dwgs, Calcs; Oral Presentation = Team with part by Each Member	250
FINAL	12-11	Final Exam	2 to 4 PM	Final Exam	Final Exam (*Individual Student*)	200
				TOTAL POINTS		**1000**